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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/696,232	10/26/2000	Mitsuru Ishikawa	07553.0017	5127
22852 7590 05/30/2007 FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER LLP 901 NEW YORK AVENUE, NW WASHINGTON, DC 20001-4413			EXAMINER OLSEN, ALLAN W	
			ART UNIT 1763	PAPER NUMBER
			MAIL DATE 05/30/2007	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

09/696,232

Applicant(s)

ISHIKAWA ET AL.

Examiner

Allan Olsen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 November 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5 and 14 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5 and 14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 March 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-4 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent 6,284,149 issued to Li et al. (hereinafter, Li).

Li teaches a method of etching a layer of BCB (16, 20) that overlies and underlies a SiO₂ etch stop layer (18) (see abstract). BCB is the cured polymer of divinyl siloxane-benzocyclobutene. BCB contains SiO₂, C and H and has a dielectric constant of less than 3 (see figure 4 and column 4, lines 1-17). Li teaches etching the BCB with plasma derived from a gas mixture comprising C₄F₈ and N₂ (see column 10, line 21 - column 11, line 35). Li teaches a patterned resist (42, 44, 18) overlies the BCB. When the via of Li's FIG. 6 is etched, overlying layer 18 functions as a mask or etching resist layer. The material of resist layer 18 is the same as the etch stop layer 14. Therefore the selectivity between the BCB and the resist layer is >2 (for example 35:1 in the case of a nitride resist, column 11, line 57). Also see: figure 5, 6, 17 or 18; column 7, lines 13-31.

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Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Li.

The above noted teachings of Li are herein relied upon. Additionally, it is noted Li teaches that Dow Chemical, the manufacturer of BCB, recommends etching BCB with a plasma comprising CF₄/Ar (column 4, lines 40-44).

Li does not teach adding Ar to the etchant when etching BCB.

It would have been obvious to one skilled in the art to add Ar to the etchant of Li because the manufacturer of BCB recommends adding Ar to a fluorocarbon etchant and adding an inert gas diluent such as argon, which is a common practice in plasma processing, provides a number of benefits including greater process control.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Li in view of US Patent 6,455,411 issued to Jiang et al. (hereinafter, Jiang).

The above noted teachings of Li are herein relied upon.

Li does not teach etching BCB with a mixture of CF₄ and N₂.

Jiang teaches that CF₄ and C₄F₈ or a mixture of the two may be combined with N₂ to etch an organic silicate (Column 3, line 27 - column 4, line 13).

It would have been obvious to one skilled in the art to use CF₄ in addition to, or in lieu of, the C₄F₈ that Li uses to etch the silicon-containing organic material because

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Jiang teaches that C_4F_8 and CF_4 are functionally equivalent with respect to etching a silicon-containing organic material. It would have been obvious to use a N_2 : CF_4 ratio of between 1:1 and 4:1 because: (1) to maintain a constant N: C ratio when changing between Li's C_4F_8 to CF_4 , Li's 45:3 ratio between N_2 and C_4F_8 adjusts to a ratio between N_2 and CF_4 of 3.75:1; (2) it is considered obvious to optimize process parameters such as flow rates; and (3) with the reasonable application of the sccm unit to Jiang's N_2 : Ar ratios (i.e., N_2 : Ar = 100:300 = 100 sccm N_2 and 300 sccm Ar), Jiang teaches using an etchant within the claimed range for the N_2 : CF_4 ratio.

Response to Arguments

Applicant's arguments filed November 21, 2006 have been fully considered but they are not persuasive.

Applicant argues:

Li, however, fails to disclose the BCB etch using a processing gas having a selection ratio greater than approximately 2.0, wherein the selection ratio is defined by an etching rate of an organic etching target film divided by an etching rate of a resist layer.

Applicant's argument appears to be based upon the low selectivity between BCB and photoresist that Li reports. However, layer 16 functions as a mask (i.e., etch resist) when the via etch depicted in figure 6 is performed (see column 7, lines 45-50).

With respect to claim 14, and in particular with respect to the claimed ratio between CF_4 and N_2 applicant argues that the reference upon which the examiner relies to provide a teaching of this limitation fails to do so.

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Jiang, however, fails to explicitly teach or suggest wherein a flow rate ratio of CF₄ and N₂ in a processing gas is set within a range of $1 \leq (N_2 \text{ flow rate} / CF_4 \text{ flow rate}) \leq 4$ (emphasis [original]).

The examiner notes that the motivation to use the claimed ratio was not taken exclusively from Jiang but rather from the teachings of Li and Jiang taken as a whole. As noted, Li teaches a C₄F₈: N₂ ratio of 45:3 and when changing C₄F₈ to CF₄, in order to maintain a constant C: N ratio, the 45:3 ratio between N₂: C₄F₈ adjusts to a 3.75:1 ratio between N₂:CF₄. The rejection also noted that it is considered obvious to optimize process parameters such as flow rate. Also, with the reasonable application of the sccm unit to Jiang's N₂: Ar ratios (i.e., N₂: Ar = 100:300 = 100 sccm N₂ and 300 sccm Ar), Jiang teaches using an etchant within the claimed range for the N₂: CF₄ ratio. Also, the rejection noted that a further motivation to use the claimed ratio was based upon the principle that is obvious to optimize such process parameters.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Chen et al (US 6,570,257) is noted because it teaches etching organic spin-on glass with fluorocarbon and N₂ with an N₂: fluorocarbon ratio between about 0 and 10.

Flanner et al. (US 6,410,437) is noted because it teaches etching organic silicates with an etchant comprising N₂ and a fluorocarbon such as CF₄ or C₄F₈.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allan Olsen whose telephone number is 571-272-1441. The examiner can normally be reached on M, W and F: 1-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

A handwritten signature in black ink, appearing to read "Allan Olsen", with a stylized flourish at the end.

Allan Olsen
Primary Examiner
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